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TITLE: (4) Magnetic heat capacity of antiferromagnetic Co, Ni, Mn, and Fe carbonates.

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ABSTRACT: The heat capacities of carbonates of cobalt, nickel, manganese, iron and calcium were measured in the temperature range 1.6 to 70°K. For the first four compounds the maximum heat capacity is observed at 17.0, 22.2, 29.4, and 30.6°K, respectively, and is associated with the antiferromagnetic transition. The data for calcium carbonate are used to calculate the lattice heat capacity and to determine the magnetic heat capacity of magnetic carbonates. The entropy of the ion magnetic-moment ordering is calculated and the lowest levels of the ions identified. Qualitative confirmation is obtained for the predictions of spin-wave theory that in carbonates of Mn, Co, and Ni at low temperatures the phonon branch of the spin waves is excited and the corresponding magnetic heat capacity is proportional to the cube of the temperature. In the case of iron carbonate, where this branch could not be

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excited, the magnetic heat capacity is found to be one order of magnitude smaller. The values of the proprotionality coefficient for cobalt, nickel, and manganese carbonates (13.5, 15.3, and 18.0 multiplied by 10**-4 joule/mole multiplied by 10**4, respectively) are from 10 to 20 times larger than the corresponding constants for the lattice heat capacity, and agree with the values calculated from magnetic measurements. Excitation of the second branch of the spin-wave spectrum is observed at temperatures close to one-tenth the Neel temperature for manganese carbonate and one-third the Neel temperature for cobalt and nickel carbonates. In conclusion, the author wishes to express his deep gratitude to A. S. Borovik-Romanov for continued interest and supervision in the work, to Academician P. L. Kapitsa for constant interest in the work and to Corresponding Member P. G. Strelkov for sharing his experience in the measurement methods. There are 6 graphs and 2 tables.

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